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Diseases of the Gardenia

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Diseases of the Gardenia

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New Jersey leads all states in the production of gardenias for cut-flower and pot-plant sale. A recent survey estimates that an area of about a million square feet under glass is devoted to gardenia culture in New Jersey, half a million square feet in California, and successively decreasing areas in Illinois, New York, Indiana, and Ohio.

As this industry has grown in size and intensiveness, the number and seriousness of its problems have grown apace. Not the least of these is the control of parasitic and nonparasitic diseases.

Parasitic Diseases

The high humidities maintained in greenhouses and continual syringing are responsible for the spread of several gardenia parasites. Although these practices are conducive to the production of large, green, glossy leaves of the type preferred by the trade, quality plants can be grown where humidities are lowered slightly by proper ventilation and heating and where water is not applied to the leaves and stems.

Canker

The most common disease of gardenias is canker. Although of rare occurrence ten years ago, it is now present in all the major gardenia-producing areas in the United States.

Symptoms.—Brown, dead areas on the stem, usually near the soil line, are the first symptom. The areas are at first sunken, and as they enlarge, the stem tissue becomes rough and corky (fig. 1). Later, cankers may also form on branches. The fresh tissue in the vicinity of the cankered area is light to deep orange, in contrast to the greenish-white tissue of unaffected stems. The foliage above the diseased area wilts and dies when the canker completely girdles the stem, checking the movement of nutrients.

The most positive signs of the disease are black pin-point bodies (pycnidia) formed on the cankered tissue (fig. 2).

Cause.—The fungus *Phomopsis gardeniae* causes canker. It is a weak wound parasite, since it penetrates the stems only through wounds and has never been observed to enter uninjured tissues.

Manner of Infection and Spread.—In commercial greenhouses, a large percentage of infection starts at the leaf joints on the base of the cuttings after these are set in the rooting medium (fig. 3). Commercial growers usually remove the lower leaves with a sharp knife or by hand, before embedding the cuttings. These freshly cut surfaces furnish excellent points of entrance for the fungus and are important foci for later infection. Thus, in propagating the plants, the growers unknowingly provide ideal conditions for fungus invasion.

FIG. 1. OVERGROWTH PRODUCED ON MATURE GARDENIA BY CANKER FUNGUS INFECTION

FIG 2. BLACK PYCNIDIA WHICH CONTAIN CANKER SPORES (Enlarged)

The propagating medium, which usually contains a considerable quantity of peat moss, is an ideal resting place for the fungus. Once such a medium becomes infested by the fungus, all cuttings subsequently rooted in it are subject to infection. The pycnidia produced on a single canker number a dozen or so to several hundred, each containing thousands of spores which are released at maturity. Consequently the fungus population in the rooting medium increases greatly under ordinary growing conditions.

As a rule, the initial cankers are well differentiated from normal tissue by the time enough roots have developed to enable successful transplanting to regular soil. On many plants, however, infection is not readily visible, appearing only as a slight yellowing at the defoliated joints. Diagnosis of the disease under such circumstances is, therefore, difficult. The wide distribution of canker throughout the United States has probably occurred through the sale of such infected rooted cuttings.

Control.—The use of sterilized rooting media constitutes the most important preventive practice. Steam has proved to be the most effective sterilizer for rooting media consisting of a mixture of sand and peat. Formaldehyde may be substituted for steam when sand alone is used. Three tablespoonfuls of 40 per

cent formaldehyde is sufficient to sterilize a bushel of sand. At least one week must elapse between the formaldehyde treatment and the embedding of cuttings.

The use of certain fungicidal stem dips has greatly reduced the number of cankers on plants growing in infested soil, but the control was not so striking as that obtained with sterilized soil.

FIG. 3. YOUNG CANKERS AT LEAF JOINTS ON ROOTED VEITCHII GARDENIAS

In addition to the aforementioned practices, it is suggested that syringing of plants in permanent beds be reduced to a minimum, since this practice tends to spread spores from diseased to nearby healthy plants. Moreover, it is apt to bruise the stems in the vicinity where they are tied by raffia and thus provide a

point of entrance for the fungus. Syringing also tends to create conditions favorable to spore germination and infection.

Mealy bugs should be controlled by the use of the proper spray, since they also provide wounds necessary for infection.

Bacterial Leaf Spot

Only a single outbreak of bacterial leaf spot has been found in greenhouse-grown gardenias in New Jersey.

Symptoms.—The spots vary from pin-point dots to ovoid or circular areas 6 mm. in diameter (fig. 4). The smallest spots may be entirely water-soaked,

Fig. 4. Spots Produced by Bacterial Infection

Fig. 5. Spots Produced by Rhizoctonia Fungus on Gardenia Leaves

whereas the centers of the larger spots are brown or reddish brown and are usually surrounded by narrow water-soaked margins.

The formation of several spots on a leaf results in yellowing and premature defoliation. In the outbreak studied in 1938, the spots increased in numbers and spread upward on the plants throughout the late fall. As a result of the severe spotting and yellowing, more than half of the foliage dropped from the plants within three months after the first spots were observed.

Cause.—Bacterial leaf spot is caused by a bacterium belonging to the genus *Phytomonas*. Spots have been reproduced artificially by inoculating healthy leaves with the bacteria isolated from naturally infected material. The organism is a weak parasite and requires exacting environmental conditions such as extremely high humidities and cloudy weather to produce considerable infection. It affects most of the commonly grown varieties with equal severity.

Control.—The 1938 outbreak was checked by complete eradication of all plants in the greenhouses; disinfection of pots, benches, and soil; and the use of cuttings from disease-free stock. The disease did not reappear in the same greenhouses during 1939.

Rhizoctonia Leaf Spot

A new and apparently previously undescribed disease, Rhizoctonia leaf spot, has recently been found in several greenhouses, principally on the variety Pride of Daisy Hill.

Symptoms.—The spots, varying in color from tan to dark brown and in diameter from 0.5 to 1 cm., are more or less circular and, in many instances, zonate (fig. 5). Young spots appear water-soaked under conditions favoring rapid spread of the fungus in the leaves. A translucent ring usually surrounds spots where further growth of the fungus is checked by a dry atmosphere.

The spots first appear on the lowermost leaves and spread upward only when the plants are kept excessively wet or overcrowded. In most instances fungus infection is confined to the leaves. Occasionally, however, it spreads down the midrib, killing the entire leaf, and continues down the petiole and stem, resulting in death of these parts.

Cause.—A fungus belonging to the genus *Rhizoctonia* causes this leaf spot. The exact species involved has not yet been determined, although it does not resemble the various species described on other plants.

Spots have been produced on healthy gardenias within one to three days after inoculation with bits of the fungus. Artificial inoculations showed that all commonly grown gardenia varieties are susceptible, although the disease occurs mainly on the variety Pride of Daisy Hill in commercial ranges at present.

Control.—Rhizoctonia leaf spot can be checked readily by sanitation and by manipulation of environmental conditions. All lower leaves should be picked off and burned as soon as they become spotted. The plants should be spaced adequately. If syringing is practiced to curb mealy bugs, it should be done only in the morning on clear days so that the plants will dry off as rapidly as possible. Ventilators should be adjusted to allow free movement of air.

On the basis of work with similar diseases, the use of a protective fungicide containing copper should check further spread. Copper sprays are not generally recommended for gardenias, however, because of the unsightly residues which persist for a long time and reduce the salability of the plants.

Root Knot

Swellings or galls on the roots of gardenias are a symptom of the root-knot or club-foot disease (fig. 6). The production of knots or swellings inter-

feres with the normal water and mineral absorption of the plant, resulting in weak, yellow or stunted growth of the above-ground parts. In many instances, the distal part of the root dies.

Cause.—Root knot is caused by microscopic, eel-like worms known as nematodes (*Heterodera marioni*) (fig. 7). These nematodes can live free in moist soil, in water, in decaying vegetable material, or within the roots of susceptible plants. As a rule, injury to gardenias by nematode infestation is not readily noticed in 1-year plants. The typical yellowing and dwarfing symptoms are more pronounced on plants held over for second year production.

Control.—Once soil becomes infested it remains so unless specially treated. The nematodes can survive in small particles of soil adhering to pots and benches; consequently any eradicatory practice must be very thorough.

As a rule, root nematodes do not survive in soils exposed to temperatures of 32° F. or below. For that reason they seldom become a problem on outdoor plants in the northern latitudes and are severe only in greenhouse soils.

Root knot may be controlled most effectively by steam sterilization. The worms succumb to temperatures of 110° F. and above. Obviously, heat treat-

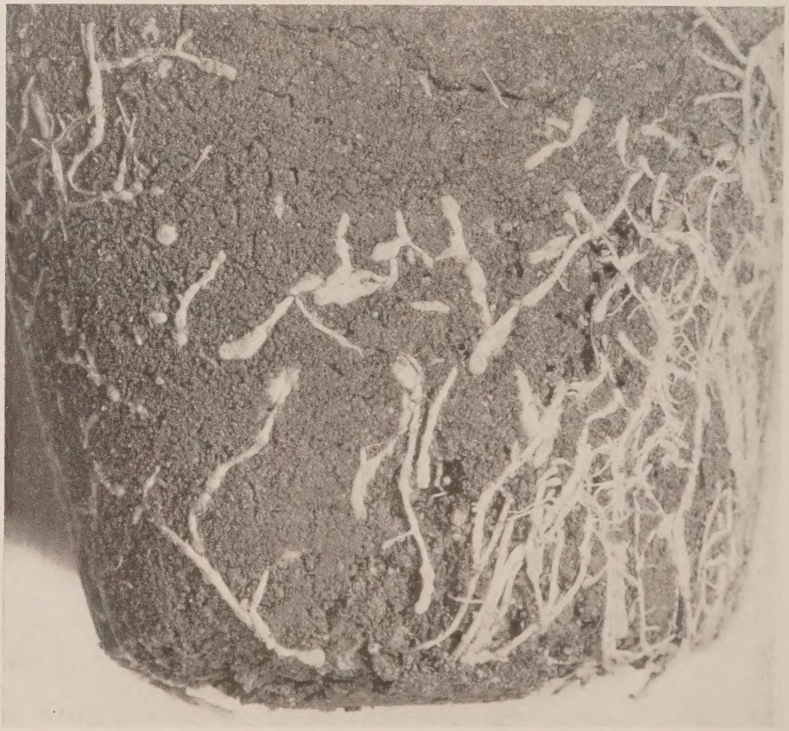

Fig. 6. Characteristic Swellings Caused by Nematodes on Gardenia Roots in Potted Soil

ments must be applied before healthy plants are set into the soil. Care must be taken to insure sufficient heating of all parts of the bed or soil to a considerable depth. The control in ground beds is more difficult, since nematodes have been known to penetrate the soil to more than 30 inches.

The use of chemicals is also effective in controlling nematodes. Though it is doubtful that complete eradication can be obtained by such chemicals as chloropicrin (tear gas) and carbon bisulfide, the population can be reduced

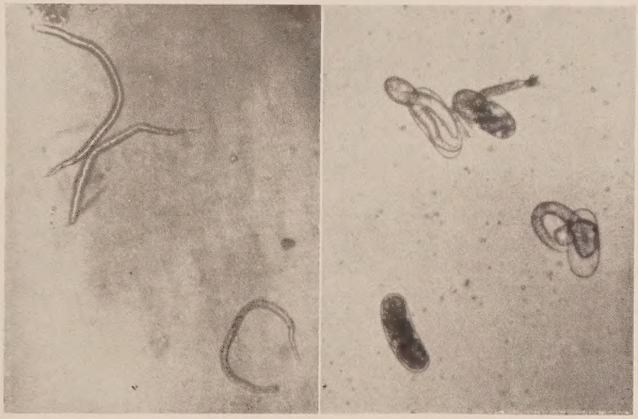

FIG. 7. LEFT—MATURE NEMATODES
RIGHT—EGG OR CYST STAGE OF NEMATODES
(Magnified 50 times)

enough to give practical control. As these chemicals are highly toxic to growing plants, they can be used only on soil free of plants. Several weeks should elapse between the treatment and planting.

Plants infested by root nematodes cannot be cured; consequently, control rests primarily in prevention.

Nonparasitic Diseases

Bud Drop

Symptoms.—The flower buds turn yellow and drop off, usually, just before they open.

Cause.—Bud drop is a nonparasitic disease. The same growth-producing factors which tend to increase the number and size of gardenia flowers; namely, high temperature, humidity, soil moisture, and fertility, also increase the dropping of buds in midwinter, a loss which is aggravated by a lack of sunlight.

Control.—Control of bud drop may thus include the use of cooler houses and drier air and soil, insofar as is consistent with good yields and plant growth. It is also important to start the winter period with large, healthy plants, which are not too soft in type of growth, and so contain relatively large reserves of

sun-made foods (carbohydrates) in leaves and stems. In practice, this is made possible by developing good-sized plants by September, then checking the growth by reducing the temperature, humidity, soil moisture, and fertility as much as is practical for 10 days to 2 weeks. Thereafter, a moderate growth may be induced by manipulating the aforementioned factors in relation to plant condition and weather.

Chlorosis

Yellow (chlorotic) leaves may appear when environmental factors vary sufficiently from the ideal to cause a considerable slowing up of the plant's development. Perhaps the most common causes are cold wet soil; too cold or too dry atmosphere; too alkaline soil reaction; and excesses or deficiencies in any of the necessary plant nutrients.

Cold wet soils and cold dry air can be controlled by proper watering, heating, and ventilation.

No deficiencies or excesses of chemical nutrients should occur if the soil is properly prepared. A good field soil should be composted with one-fourth to one-third by volume of strawy manure and the addition of superphosphate at the rate of 25 pounds to the ton of manure. Before the soil is used, its acidity can be increased by the addition of acid leaf mold or sulfur. If sulfur is used it is best added during the making of the compost pile and in quantities recommended by a soil specialist.

At times it may be necessary to increase soil acidity during the growing season. Applications of sulfate of ammonia, 1 ounce in 2 gallons of water, followed by aluminum sulfate at the same rate are satisfactory. The soil reaction should be tested before each application and additional aluminum sulfate used until the correct reaction is obtained.

If all of the aforementioned factors have been corrected and the leaves still remain yellow, lack of iron may be indicated. Ferrous sulfate, 1 ounce to 4 gallons of water, can be added to the soil to overcome iron deficiency.

Cultural Requirements

Constant attention to the various and exacting cultural requirements is necessary to grow gardenias successfully under glass.

The necessity of the proper physical condition of the soil cannot be overemphasized. Fertile friable loams or sandy loams are good types of soil. The addition of coarse sand and a coarse acid leaf mold, containing many small unrotted roots, to soils high in clay will improve their physical condition. Gardenias prefer an acid soil, one with a reaction of pH 5.0 to 5.5. The injurious effects from a less acid soil are minimized if the soil is well drained and aerated, and watered with extreme care so that the soil does not become cold and wet.

Gardenias also require an abundance of sunlight and humidity. Overcrowded plantings, with the resultant decrease in amount of sunlight, reduce the yield of flowers for cutting. The day temperatures should be between 68 and 80° F. and the night temperatures from 55 to 65° F.